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RESOLUTIONS OF THE COORDINATION COMMITTEE ON THE SUBJECT
"STRENGTH OF THIN-WALLED CONSTRUCTIONS"

By

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RESOLUTIONS OF THE COORDINATION COMMITTEE ON THE
SUBJECT "STRENGTH OF THIN-WALLED CONSTRUCTIONS"
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V. S. GUMENYUK

On May 23-24 1960 in the city of Dnepropetrovsk was held a coordination session concerning the strength and dynamics of thin-walled structures, called by the coordination committee dealing in the subject of "Strength of Thin-Walled Constructions" pertaining to the problem of "Scientific Foundations of Strength and Plasticity".

In the conference have participated 75 representatives of Scientific-Research Institutions, schools and enterprises of Kiev, Dnepropetrovsk, Lvov, Kharkov, Zaporojche, Berdyansk and other cities of the Ukrainian SSR.

At the session were presented and discussed 15 reports with actual questions pertaining to strength and dynamics of thin-walled constructions. A greater part of the conference was devoted to explain the operations of the scientific-research institutions and establishments of the Ukraine for the year 1959.

Academician of the Ukrainian Academy of Sciences G.M.Savin spoke at first about the basic trends of developing mechanical investigations during the past 15 years.

His second lecture was devoted to general investigations on the concentration of stresses around openings in shells. These problems have been discussed in the lecture presented by Dr.Tech.Sc.Yu.A.Shevlyakov.

In the lectures presented by Dr.Phys-Math.Sc. V.I.Mossakovskiy, aspirants Petelin. L.I.Manevich, assistant prof. V.I.Merkulov, aspirants B.N.Bublik and S.D.Leytes were discussed investigations on the stability of shells with rigidity "ribs" and smooth shells as well.

Cand.of Techn.Sc.Ya.S.Podstrigach told about stressed-deformed state of shells which are exposed to the effects of external forces and nonuniform heating.

Dr of Phys-Math.Sc.M.Ya.Leonov devoted his lecture to the study of the

approximate theory of torsion of thin-walled rods of closed and open profile.

In the report by Dr.Tech.Sc.V.A.Lazaryan were discussed problems concerning the dynamics of rod systems.

The stressed state in an elliptical disk under the influence of concentrated forces was elucidated in the report of Cand.Tech.Sc. P.M.Kichayev.

Several lectures have been devoted to solid body namely: report by Dr.Phys-Math Sc. M.Ya.Leonov; Cand.Phys-Math Sc. V.V.Panasyuk and aspirant P.M.Vitvits'kiy.

All reports have been actively analyzed by the members of the conference and they attained high evaluation.

The coordination committee has emphasized, that the fundamental development of investigations on the problem of strength of thin-walled constructions for the next 15 years should follow a trend , mentioned in the resolutions of the scientific committee of the Academy of Sciences USSR dealing in problems of " Scientific Aspects of Strength and Plasticity " dated March 30, 1960.

These resolutions include:

1. Studying equations of state and formulation of a general theory of elastic-plastic deformations of solid bodies and the establishment of relationship between the physico-chemical mechanism of deformation of solid bodies and the mechanical elastic-plastic properties of materials.

Special attention should be devoted to experimental investigation of elastic-plastic properties and conditions of ruining metals, alloys, polymers and other structural materials, isotropic and anisotropic during difficultly loaded (stressed) and various conditions of stressed state and various aggressive media and wide range of temperatures, compressions, time and rate of deformation.

The results of investigating this aspect should become a theoretical foundation in solving problems of strength and plasticity, interaction of solid bodies with flows of gas and liquids. They are of first line importance for science and technology.

2. Development of theoretical and experimental methods of determining plastic deformations , strength and carrying ability of constructions, machines and installation under heavily stressed state , high and ultra high stresses. Special attention should be devoted to the theory of calculating completed deformations and plastic flows to improve and formulate effective methods of treating materials under pressure and cutting, and to develop theories of planning minimum weight constructions and methods for utilizing high speed computation technique in computation-structural practice.

3. To investigate strength and plasticity of structural elements in the presence of aggressive media.

The investigation results are of great importance for the formulation of a theory for calculating the strength of energy installations.

4. To investigate creep and permanent strength of constructions ,which are exposed to complex stressed state, at changed loads, irregular and nonstationary temperature distribution, high and ultra high pressures.

The results are of great importance for the development of a theory of calculating creep and permanent strength of elements of jet engines, gas and steam turbines, thermal power plants, massive concrete installations.

5. Investigating the strength of materials at very high and also very low temperatures, formulation of a theory of calculating bodies in the presence of high temperature fluctuations and nonstationary thermal fields and the development of brittle strength criteria. The results will find application in the planning of jet engines, heat emitting elements of nuclear reactors etc.

6. Formulation of a theory and experimental methods of investigating the widening and reflection of elastic-plastic and shock waves in solid bodies, interaction of solid bodies, which collide at cosmic velocities, with consideration of the phase conversions and intensive thermal effects.

The results of the mentioned investigations will find applications in the develop-

ment a theory of calculating the strength of stationary and movable objects during short-lived impact and explosive stresses in the theory of ruining obstacles, destruction and breaking up of mountain rocks by the effect of shock waves, in the theory of calculating on seismo-stable and dynamic theories of technological processes of plastic flow.

7. To formulate a general nonlinear theory of stability of deformation processes of a solid medium, development of theoretical and experimental methods of investigating stability of stationary and nonstationary methods of interaction of hollow system with gas and liquid flows, stability of rod systems, plates and shells.

The results of the investigations are of great importance for science and technology and will form a theoretical base for planning stable and safe working conditions for bodies of ships and aircraft, wings, propellers, turbine blades, which move in gas and liquid at greater velocities, structural units.

8. Investigations of general properties of linear and nonlinear equations of the theory of elasticity and plasticity, formulation of methods for solving same for foreign bodies and thin-walled constructions with application of high speed computation technique, application of the theory of elasticity in studying problems of stress concentration and dislocation mechanisms of plasticity.

The results of this work program will be of great importance for science and will find broad application in the field of new technology, aviation and ship building, transportation and power machine construction, construction, hydro engineering and in mining.

9. The development of the theory of nonlinear elastic and elastic-plastic oscillations of bodies, machines and constructions, development of methods for their calculation into periodic, movable, impulsive and accidental loads.

The results are of great importance in the development of theories of dynamic phenomena and fatigue phenomena and will find broad application in aviation, machine building and construction.

10. Investigation of fatigue and development of methods to determine the strength of machines and constructions at variable stresses with consideration of irreversible phenomena in materials, surface phenomena, which originate in processes of repeated stressing of materials during interaction with surrounding medium, fatigue of material depending upon the nature of stressed state, its heterogeneity, conditions which do change with time, temperature, state of surface layers, thermal processing and nature of previous plastic deformation.

Investigation of the fatigue mechanism and introduction of methods of calculating fatigue in the practice of construction will allow to raise the service life of constructions and improve their operational reliability.

11. Creation of machines for static testing under complex loads, to investigate creep; creation of stands for testing materials and structures under impact, explosive and changed loads, to investigate mechanical qualities of machines, materials and constructions; to develop new electrical, optical and mechanical methods of measuring deformation and stresses at high rates of deformation, at high overloads, pressures at very high and very low temperatures.

The results of these investigations should assure the attainment of a new level of testing methods for testing strength of newly formed materials, constructions and devices, new equipment with respect to their productiveness, capacity and broad range of conditions for their application. This will liquidate the backwardness in the front of experimental investigations.

12. Development of methods of structural mechanics to determine strength, rigidity and stability of new types and systems of constructions and installations.

13. Studying the statics and dynamics of loose media, distribution of pressure in these media, propagation of shock waves in them, studying the interaction of loose media with solid ones by elastic and inelastic deformed bodies.

The results of these investigations will have great importance for increasing the reliability of hydrotechnical, industrial, city (communal) installations, to

increase the output of ground digging , ground excavation and other machines.

To successfully execute the mentioned investigations , the coordination committee recommended :

- a) with the assist of mechanics faculties of the Kiev, Dnepropetrovsk, L'vov universities are organized scientific research institutions modeled according to the Institute of Mechanics of the Moscow University;
- b) to sharply increase the training of specialists of higher qualification - doctors of science;
- c) broader and more sensible inclusion of youth in the development of scientific subjects;
- d) to pay special attention to instructions of aspirants and dissertations for proper selection of actual subjects, connected with the above mentioned trends;
- e) To admit, that within the period from the first coordination conference up to this day there was insufficient development of strength investigations of thin-walled constructions in linear set ups, experimental investigations of strength and stability of shells , investigations of elastic-plastic stressed state of thin-walled constructions and carrying ability of thin-walled structures;
- f) to schedule the following conference for May 1961 in the city of L'vov, To organize and commission the Institute of Mechanics and the Institute of Machine Technology and Automation at the Academy of Sciences Ukr-SSR;
- g) to establish, that in spite of the resolutions of the first conference on the necessity of formulating a general plan of scientific-research investigations ,carried out by scientific institutions , schools and establishments of the Ukr-SSR, none of these institutions have up until now send in their plans;
- h) to appeal to the Ministry of Higher Education and Medium Special Education and to the Presidium of the Academy of Sciences Ukr-SSR to allow to publish in form of an information bulletin, an annual report on the progress made by the conference.

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